Remarks/Arguments

Claim Rejections - 35 USC ' 103

Claims 1-25 were rejected under 35 U.S.C. 103(a) as being unpatentable over *Gadeyne et al (U.S.* Patent 6,359,663) in view of Ho *et al (U.S.* 6,208,327), Iwaki (JP Patent No. 08088770), and further in view of Timm (U.S. Patent 6,246,389), and further in view of *Sani et al* (U.S. 6,219,101).

Regarding independent **claims 1, 12 and 19,** and for **claims 2-7, 12-15 and 20-22,** the office action states, "Gadeyne teaches a method of reducing artifacts in an image display by teaching the conversion or generation of a video signal so that motion artifacts which are caused by the difference in luminance response times for rise and decay are canceled out *(see* Abstract; column 2, lines 4551). This is accomplished by displaying images of TV pictures and/or data information on a video display system equipped with a liquid crystal display device (column 1, lines 8-13)." The office action further states, "Gadeyne teaches how a video signal for a picture is converted into different levels of luminance with different rise and fall times (column 2, lines 45-67)."

By this amendment independent claims 1, 12 and 19 are amended to more clearly state in the preamble the problem addressed by the claimed invention. That is, a method and circuit for "reducing sparkle artifacts due to non linearity in a transfer function of a liquid crystal imager " Applicant hopes this amendment to the preamble will help clarify the fundamental difference between applicant's claimed invention and the teachings of the cited prior art. Dependent claims 2, 4, 6 and 13 have been amended to as described below. Where a step of "dividing" was recited in a claim, the claim has been amended to recite "decomposing" instead of "dividing". Decomposing is a broader term describing a process that may include a step of dividing, but wherein the decomposing step is not necessarily completely performed by a dividing step.

Gadeyne

Applicant's claimed method and apparatus are not directed to reducing artifacts related to the difference between luminance rise and fall times typical for an

LCD display. Applicant's claims are directed to a method and apparatus "reducing sparkle artifacts due to non linearity in a transfer function of a liquid crystal imager." These are entirely different phenomena.

Gadeyne teaches a method of reducing artifacts related to the difference between luminance rise and fall times typical for an LCD display device. (Gadeyne col 2, lines 20-30). Gadeyne defines the term "luminance response" on (Col 1 lines 53-55) "The luminance response time being the time needed to reach the correct luminance on the display screen in response to an immediate change in a corresponding drive signal..." It is important to note the distinction between artifacts caused by "luminance response time" variations, and those caused by non linearities in a transfer function of the imager. Transfer function non linearity refers to the relationship between drive voltage levels and their corresponding correct luminance values, **regardless of how long it takes to reach a correct luminance value**. This phenomena is explained in applicant's specification page 3 lines 21 -35.

Specifically, applicant noticed situations wherein adjacent pixels having only moderately different intended (correct) brightness levels were driven by very different voltage levels. This occurrence is not related to the time to reach the intended/correct luminance level. Rather, it is a direct result of the non linearity in the drive transfer function. The different voltage levels produce an electrical field having a component orthogonal to the desired field, producing a brighter pixel than intended. In contrast, luminance response time variations do not cause brighter than intended individual pixels.

Gadeyne teaches a way to affect the time it takes a pixel to reach its intended value after the drive signal is applied (luminance response time). Gadeyne teaches to make the luminance response times substantially equal to a predefined luminance time response. (Gadeyne col 2 lines 65-67). One of ordinary skill in the art would readily recognize Gadeyne's teachings are not applicable to affect a drive level to luminance value **transfer function** and thus would not help solve the problem to which applicant's claimed invention is directed.

Gadeyne and Ho

The office action states Gadeyne does not teach reducing sparkle artifacts. The office action states, "Ho teaches this concept by teaching a method and an apparatus for eliminating image artifacts due to imaging of post spacers, and is applicable for

correction of sub-pixel defects and column disclinations that are present in any display technology that has matrix addressed pixels (column 2, lines 2634).

The office action states, "it would have been obvious to a person of ordinary skill in the art to combine Gadeyne and Ho because while Gadeyne teaches a method of reducing artifacts which are caused by the difference in luminance response times, Ho teaches a method and an apparatus for eliminating image sparkle artifacts by correcting sub-pixel defects and column disclinations that are present in any display technology that has matrix addressed pixels (column 2, lines 26-34).

The office action states, "the motivation for combining these inventions would have been to improve the image quality (column 2, lines 35-38)." Applicant respectfully submits it is not relevant to the issue of obviousness whether there is motivation to combine the teachings of Gadeyne with the teachings of Ho to improve image quality. Applicant believes the proper question is whether there is a motivation (either in the references themselves or in the general art) to combine the teachings of Gadeyne with the teachings of Ho to arrive at applicant's claimed solution to the problem of sparkle artifacts caused by non linearities in an LCD display transfer function. To that end, Gadeyne and Ho are not combinable. Nor are they individually applicable. Nor are they relevent to applicant's claimed invention. Neither Gadeyne nor Ho teach anything that would be helpful in reducing sparkle artifacts due to non linearity in a transfer function of a liquid crystal imager.

As previously discussed above, Gadeyne teaches a method of reducing artifacts related to the difference between luminance rise and fall times typical for an LCD display device. Applicant has hereinabove called to the patent office's attention the distinction between artifacts caused by "luminance response time" variations, and those caused by non linearities in a transfer function of the imager. That is, transfer function non linearity refers to the relationship between drive voltage levels and their corresponding correct luminance values, **regardless of how long it takes to reach a correct luminance value**. Therefore, Gadeynes teachings are not applicable to affect a drive level to luminance value transfer function to solve the problem to which applicant's claimed invention is directed.

Ho discloses a method and an apparatus for eliminating image artifacts due to imaging of post spacers or other small clusters of pixels that deviate from nominal performance of light valve technology. (Ho, Abstract) Ho teaches a method that accounts for different wavelength responses of each light valve (pixel) when some of

the pixels are known to have responses that deviate from the norm. (Ho col 2 lines 50-55.) Ho's method requires that the location of the pixels that have wavelength deviations be known. Once their location is known, that location must be implemented in the address scheme of a look up table. The look up table corrects the wavelength deviation from the norm for the deviating pixels. The solution taught by Ho is not applicable to affect the drive voltage to luminance value transfer function, nor would it solve the problem of artifacts due to non linearity in the aforementioned transfer function.

Furthermore, the teachings of Gadeyne and Ho are not applicable to each other. One of ordinary skill in the art would find no motivation in the references themselves, or in the knowledge generally available to apply the teachings of Gadeyne and Ho, individually or in combination, to arrive at a solution to the problem of artifacts cause by a non linear transfer function. On the contrary, one of ordinary skill in the art would readily recognize the teachings of Gadeyne and Ho are not applicable to the problem addressed by applicant.

Gadeyne, Ho and Iwaki

The office action states, "Gadeyne and Ho do not teach the step of dividing a video signal for a picture into a higher brightness level signal and lower brightness level signal." The office action further states, "Iwaki teaches dividing a video signal for a picture into a higher luminance (brightness) level signal and lower luminance (brightness) level signal (Drawing 1, itemsl-12, in Detailed Description See page 1-3, paragraphs 008-0015)."

The office action states it would have been obvious to a person of ordinary skill in the art to combine Gadeyne, Ho and Iwaki because while the combination of Gadeyne and Ho teach a method of reducing artifacts, Iwaki teaches a method of dividing a signal according to the brightness level. The motivation for doing so would have been to obtain image data whose resolution is enhanced with fidelity to a substantial image without causing a pattern such as a stripe pattern *(see* Abstract).

Applicant respectfully submits it is not relevant to the issue of obviousness whether there is motivation to combine the teachings of Iwaki with Gadeyne and/or Ho to obtain image data whose resolution is enhanced with fidelity to a substantial image without causing a pattern such as a stripe pattern. Applicant believes the proper question is whether there is a motivation (either in the references themselves or

in the general art) to combine the teachings of Iwaki with the teachings of Gadeyne and/or Ho to arrive at applicant's claimed solution to the problem of sparkle artifacts caused by non linearities in an LCD display transfer function. To that end, Iwaki is not applicable alone or in any combination with Gadeyne and Ho, as none of those reference's teachings are applicable to reducing sparkle artifacts due to non linearity in a transfer function of a liquid crystal imager.

Applicant respectfully submits there is no combination, no suggestion to combine in the references or in the generally available art, nor would it be reasonable for one of ordinary skill in the art to attempt to combine the teachings of Iwaki with Gadeyne or Ho to arrive at applicant's claimed invention.

Iwaki is not concerned with the transfer function of LCD devices. Iwaki teaches a resolution conversion circuit that addresses the problem of striped patterns in the still images provided by facsimile and similar devices. Applicant respectfully disagrees with the office action statement " Iwaki teaches a method of dividing a signal according to the brightness level." The method taught by Iwaki is not to **divide a signal** according to a brightness level. The method is to **divide/scale a brightness range** ("read range") into three equal divisions by providing two threshold values as reference values for the scale. An input video signal is classified as a high, medium or low luminance signals based on a judgment of how the video signal level compares to the threshold values. Accordingly the luminance value for a single pixel is represented by two pixels having light dark state combinations determined by the classification.

In contrast applicant claims a step of decomposing a video signal for a picture into a higher brightness level **signal** and a lower brightness level **signal**. This is more than merely classifying the signal according to a scale. The high level signal and the low level signal are separate from each other and each is applied to a different processing circuit.

Therefore it is understood by those of ordinary skill in the art that the division taught by Iwaki relates to dividing a range to create a scale to which a signal can be compared, and not to dividing the signal itself.

Specifically, Iwaki discloses a threshold level generating circuit 10 that provides two thresholds TH2 and TL2 to a comparator 8. The thresholds provide a [luminance] read range into three **equal** portions, high, medium and low. (translation page 1, CONSTITUTION.) In addition, delay and comparator circuits provide

discriminated picture element luminance data to comparator 8. Comparator 8 compares the luminance of the picture element data with the threshold levels. Depending on the outcome of the comparison, various combinations of black and white "two pixel" data are provided. Therefore Iwaki teaches a method and circuit for converting one pixel data into two pixel data. (TITLE).

Gadeyne, Ho, Iwaki and Timm

The office action states, "Gadeyne, Ho and Iwaki do not teach a method for slew rate limiting different brightness levels." The office action further states, "Timm teaches a methodology wherein after the numerical value of a samples displayed by a specific pixel is decided and the numerical value of another sample is then decided (such as the higher and lower brightness taught by Iwaki), then the predictor of the slew rate between the two samples is calculated and the brightness that corresponds to the slew rate is calculated (404) wherein the determined brightness is used for the pixel (406) (see Abstract)."

The office action concludes it would have been obvious to a person of ordinary skill in the art to combine Gadeyne, Ho, lwaki and Timm because, as asserted by the office action, "while the combination of Gadeyne, Ho and lwaki teach a method of reducing artifacts that utilizes a method of dividing a signal according to the brightness level, Timm teaches how to parse the divided video signals based on the slew rates." The office action further states, "The motivation for doing so would have been to achieve a system that provides intensity variation for slew rate with high speed and low cost (column 1, lines 55-57)."

Applicant respectfully submits it is not relevant to the issue of obviousness whether there is motivation to combine the teachings of Gadeyne, Ho and lwaki with Timm to achieve a system that provides intensity variation for slew rate with high speed and low cost. Applicant believes the proper question is whether there is a motivation (either in the references themselves or in the general art) to combine the teachings of Gadeyne, Ho and Iwaki with Timm to arrive at applicant's claimed solution to the problem of sparkle artifacts caused by non linearities in an LCD display transfer function. To that end, Timm's teachings about using slew rate based intensity variations to mimick analog vector CRT behavior in digital graphics displays are not applicable alone or in any combination with Iwaki, Gadeyne and Ho, as

Timm's slew rate teaching is not applicable to reducing sparkle artifacts due to non linearity in a transfer function of a liquid crystal imager.

Contrary to the office action statement, applicant does not believe Timm teaches a methodology wherein after the **numerical value of a samples** displayed by a specific pixel is decided and the numerical value of another sample is then decided (such as the higher and lower brightness taught by Iwaki), then the predictor of the slew rate between the two samples is calculated and the brightness that corresponds to the slew rate is calculated (404) wherein the determined brightness is used for the pixel (406) (see Abstract)."

The **"numerical value of the samples"** referred to in the office action do not represent brightness "such as the higher and lower brightness taught by Iwaki". On the contrary, the fact that these samples do NOT contain brightness values is a problem Iwaki tries to solve. The numerical values represent only waveform magnitudes. (Applicant suggests it may be helpful to think of a digital oscilloscope displaying for example, a square waveform). The magnitude of vertical change between sample points is used as a vector into a pre-computed table of intensity values. (Timm abstract and col 3 lines 17-21). It is this difference in magnitude that is used to impute a slew rate and a corresponding intensity level for a pixel. Significantly, there is no limiting of slew rates disclosed anywhere in Iwaki's disclosure.

Tim defines slew rate as "...the velocity of the electron beam across the face of the display". (Timm col 1 lines 18-20). In other words, a waveform (signal) being displayed on a CRT (as with an oscilloscope) has a high intensity where the slew rate of the electron beam is relatively slow and may have a lower intensity where the slew rate is relatively high. This type of slew rate phenomena is related to the persistence of the phosphors of CRT display devices. (Timm, col 1 lines 23-26.) Digital graphics displays sample the waveform to be displayed. The samples are used to drive addressable pixels. However, unlike the display devices of the cited references and of applicant's invention, in the type of display taught by Timm, the resulting waveform samples do not control pixel intensity. Therefore, intensity variations in the pixels must be accomplished in some other manner for this type of display. Timm teaches to provide the pixel intensity information by a deriving a slew rate of a waveform based on the magnitude of the vertical change of the waveform between samples. (Timm,

col 1 lines 60 -62.). The derived slew rate of a point, or segment, of the sampled waveform is translated in to a pixel intensity value.

Such an operation cannot be applied to LCOS displays for television signals. One reason is the television video signals that drive the display elements are fundamentally different than the signals provided by a waveform being sampled for display on an oscilloscope. Television signals do include luminance (pixel intensity) information. Therefore, there is no need to derive luminance information from the level changes of the waveform of the input signal. Applicant is concerned with the relationship of the level of the luminance drive signal provided to the display element and the intended corresponding luminance of the element itself.

Tim teaches to make the intensity of a pixel proportional to the slew rate of the input video signal or waveform, being sampled for display. The slew rate is derived by computing the inverse of the magnitude of the vertical change of the sampled waveform between samples. (Timm col 3 lines 4-6). This teaching is not applicable to, or combinable with any of the cited references for at least two reasons. First, because the term "slew rate" as defined by Timm refers to the shape of a waveform (signal) being displayed (as in a waveform displayed on an oscilloscope). Applicant's method is not concerned with the shape of the objects to be displayed on an LCD device. Applicant's "slew rate" refers to a change rate in luminance drive level from pixel to pixel. Second, Timm does not teach **limiting** a slew rate as recited in applicant's claims.

Applicant respectfully submits there is no combination, no suggestion to combine in the references or in the generally available art, nor would it be reasonable for one of ordinary skill in the art to attempt to combine the teachings of Timm with any of the cited references, alone or in combination to arrive at applicant's claimed invention.

Sani

The office action states Gadeyne, Ho, Iwaki and Timm do not teach a low pass filter that filters the lower brightness level signal component of a video signal. The office action states, "Sani teaches this concept by teaching how to filter various luminance components of a video signal (column 1, lines 50-58; column 4, line 61 through column 5, line 48, figure 3)." The office action concludes, "it would have been obvious to a person of ordinary skill in the art to combine Gadeyne, Ho, Iwaki

and Timm and Sani's inventions because while the combination of Gadeyne, Ho, Iwaki and Timm teach a method of reducing artifacts that utilizes a method of dividing a signal according to the brightness level and then how to parse the divided video signals based on the slew rates, Sani teaches how to filter various luminance components of a video signal (column 1, lines 50-58; column 4, line 61 through column 5, line 48, figure 3)." The office action states, "The motivation for combining both inventions would have been to prevent flickering in a display device (column 1, lines 50-58)."

Applicant respectfully submits there is no combination, no suggestion to combine, nor would it be reasonable for one of ordinary skill in the art to attempt to combine the teachings of Sani with any of the other references cited to arrive at applicant's claimed invention. The motivation to combine suggested in the office action (to prevent flickering) does not exist because Sani's teachings about filters are directed solely to preventing an interlace flicker phenomena associated with interlaced scanning displays, i.e., video signals comprising two video fields per frame. Interlaced scanning is a method of producing an image on a Cathode Ray Tube (CRT) type display. Applicant's invention is directed to LCD type displays. Due to the fundamental difference between CRT type displays and LCD type displays, interlaced scanning is not applicable to LCD display devices. The term "interlace flicker", and the specific phenomena Sani refers to, is defined by Sani at col 4, lines 11-32. Sani's definition of flicker, and the solution he teaches, clearly precludes application or combination of Sani's teachings with any of the other references to solve the LCD display problems addressed by the applicant's claimed invention.

Flicker, as defined by Sani, arises when there is an isolated luminance signal (Y) present in the first field, but not in the second field, of the horizontal scan lines of an interlaced signal. The isolated luminance signal occurs as a result of the conversion of a progressive scan luminance video signal to an interlaced scanned signal. (Sani col 4 lines 33-41, Sani, claim 1) There is no suggestion in Sani, nor would it be reasonable for one of ordinary skill in the art, to combine the teachings of Sani about filtering Y signals in scan lines appearing in one field of an interlaced signal, with the teachings of any of the other cited references in order to address the problem of sparkle artifacts due to non linearity in the drive voltage to luminance transfer function of LCOS display elements.

Gadeyne distinguishes the type of problem addressed by Gadeyne "luminance jump" in LCD displays from the "luminance flicker" phenomena of the type addressed by Sani. Gadeyne states, "...these [luminance flicker -Sani] phenomena are not due to the difference between luminance rise and fall times, but rather to how image lines are written." (Gadeyne col 2 lines 7-11.)

Having fully addressed the Examiner's rejections it is believed that, in view of the preceding amendments and remarks, claims 1-29 as amended stand in condition for allowance. Accordingly then, reconsideration and allowance are respectfully solicited. If, however, the Examiner is of the opinion that such action cannot be taken, the Examiner is invited to contact the applicant's attorney at (609) 734-6892, so that a mutually convenient date and time for a telephonic interview may be scheduled.

No fee is believed due. However, if a fee is due, please charge the additional fee to Deposit Account 07-0832.

Respectfully submitted,

By: Christine Johnson
Reg. No. 38,507
Phone (609) 734-6892

Patent Operations
Thomson Licensing Inc.
P.O. Box 5312
Princeton, New Jersey 08543-5312
Date: January 12, 2004

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Natalie Brottman